

road about two miles further up the river. The Grand Trunk Railway Company has decided to build a single arch steel bridge across the river, 600 feet in length, at an estimated cost of \$200,000. Work will be commenced in the spring.

LONDON, ONT.—The City Engineer has been instructed to prepare specifications for lighting the city with electric light for terms of one, three, five or eight years, and to submit the same at the next meeting of Council, after which tenders will probably be invited.—Building permits have been issued as follows: John McCaughlin, two brick cottages on William street, Central and Princess avenues, cost \$1,200 each; John Mills, Charlotte street, brick cottage; Mr. John Purdom, York street, two brick veneer cottages.

BROCKVILLE, ONT. It is reported that several New York capitalists are negotiating for the purchase at Charleston Lake, of a site for the erection of a terrace of houses.—Mr. G. A. Allan, architect, is preparing plans for the following work: alterations to business block, corner King st. and Court House avenue, for Mr. W. H. Comstock; block of stores and offices on King street for the Dunham Estate and Mr. S. Flint; alterations to store on King street for Mr. Robert Neil Messrs. Liston & Liston, architects, have prepared plans for alterations to St. Lawrence Hall, for the proprietor, Mr. Amos Robinson.

HAMILTON, ONT.—Mr. J. J. Morehouse manager of the proposed smelting works, will shortly ask for tenders for the supply of 500,000 bricks for use in the buildings to be erected in connection with the works. At the last regular meeting of the Board of Education, it was moved that the Finance Committee make arrangements to build new schools in wards Nos. 1 and 4. The matter was referred to a special committee.—Tenders are invited by Ald. Hannaford, Chairman Waterworks Committee, until Wednesday, the 21st inst., for the supply of service brasswork, lead pipe, pig lead, stop valves, hydrants, 2½ inch rubber hose, stop cock boxes, cast iron pipe, special castings and ordinary castings.—A building permit has been issued to Charles Mills, for a pair of two story brick dwellings on Wellington street, between King and Main streets, cost \$2,500.

TORONTO, ONT.—At the last meeting of the Parks and Gardens Committee of the City Council, it was decided to enlarge the conservatory in the Horticultural Gardens, at a cost of \$5,000.—The annual report of the Boys' Home on George street contains a recommendation that the question of heating the infirmary be considered at once.—The scheme for the erection of a Women's University residence is making satisfactory progress, and will in all probability be carried out.—The Howland Memorial Committee have issued an appeal for \$25,000 to place the Mission Union on a permanent footing and to erect a gymnasium and drill hall at the Victoria Industrial School at Mimico. The City Engineer will be asked to report on the feasibility of widening Lake Shore road and erecting a high level bridge across the road, thus securing a southern entrance into High Park.

FIRES.

Two stores of V. Brosseau, William King street and J. F. Rollands, at Bedford, Que., were damaged by fire recently to the extent of \$30,000.—The premises of the James Morrison Brass Manufacturing Company, 67 Adelaide street west, Toronto, was damaged by fire to the extent of \$30,000 on Wednesday last, the store room being totally destroyed.—Chas. Bokscal's planing mill at Windsor, Ont., was totally consumed by fire on Thursday of last week. Loss, \$15,000; insurance, \$5,000.—John A. Humphrey's steam saw mill at Moncton, N. B., was destroyed by fire last week. Loss, \$15,000; no insurance. The mill will be rebuilt at once.—The large implement warehouse of the Sylvester Manufacturing Company at Brandon, Man., was burned on the 9th

inst. Loss, \$50,000; insurance, \$5,000.—The Simcoe hotel at Barrie, Ont., was damaged by fire recently to the extent of \$15,000. Loss covered by insurance.

CONTRACTS AWARDED.

TORONTO, ONT.—Mr. A. G. McIntyre has been awarded the contract for putting in the shavings and exhaust pipes for taking the shavings from the wood working machines in the Central Prison.

KINGSTON, ONT.—Mr. G. Newlands has been awarded the contract for the erection of the new R. C. Chapel in connection with the Hotel Dieu. All the trades except the stonework will be sublet. The estimated cost of the building is \$16,000.

CORNWALL, ONT.—The Building Committee of the St. Columban's congregation have awarded the contract for new Catholic church to replace the present one to Messrs. P. Boileau & Freres, contractors and builders of Isle Bizard, Que. The plans and specifications were prepared by Messrs. Tanguay & Vallee, architects, of Quebec, Mr. John A. Chisholm, of Cornwall, is acting as solicitor for the congregation. Contract price, \$47,500.

COMPANIES APPLYING FOR INCORPORATION.

ST. HENRI, QUE.—The St. Henri Chemical Company; Dwight Brainerd, president.

OTTERVILLE, ONT.—The Otterville Brick and Tile Manufacturing Co., capital stock, \$5,000; Directors: A. B. Moore, C. B. Purvis, John Wyt and John Pennington.

MIMICO, ONT.—The Toronto Sewer Pipe and Paving Brick Co., capital stock, \$100,000; Directors: Henry Barber; Wm. Pears; F. D. Horner, and Jas. Pearson.

BUCKINGHAM, QUE.—The Gibbs-Francho-Maclaren Co., Limited, capital stock, \$50,000, to manufacture lumber, barrels, boxes, box shooks, wood pulp, lime, brick, drain-pipe, etc.

TORONTO, ONT.—The Ketchum Gas Generator Co., of Toronto, Limited, capital \$30,000.—The White-Allan Company of Toronto, capital, \$20,000.—The L. H. Young Manufacturing Co., to manufacture a reversible safety nut lock, capital, \$500,000; incorporators, Senator Ogilvie, of Montreal; Hugh Scott and Thomas Walmsley, of Toronto, and others.

BUSINESS NOTES.

A. R. Precourt & Co. will carry on business in Montreal as contractors.

Louis Monette and Ald. Valin have formed a partnership as contractors in Montreal.

The partnership existing between Messrs. E. Bowler and W. B. Malcolm, under the name of the Dominion Sanitary Pottery Co., of St. Johns, Que., has been renewed, and the business will be carried on as heretofore.

The Legal and Commercial Exchange report the following: Godfrey & Co., hardware merchants, Vancouver, B. C., have assigned to R. W. Harris.—Chas. Desmarteau has been appointed curator of the estate of J. E. Lewis & Bro., plumbers, Montreal.—James Hutton & Co. have formed a partnership in Montreal as iron, steel and hardware merchants.—John McGuire, lumber dealer, Renfrew, Ont., has assigned to T. W. McGarry.

DRAINAGE AND VENTILATION OF STABLES.

The sanitary condition of stables is a matter which has not received anything approaching the attention which it deserves. The effects of an intelligent consideration of this question, followed by the necessary action for bringing about improvement, have been strikingly instanced by Edward Tidman, of London, in a paper on "Sanitary Ventilation" recently read by him before the Surveyors' Institute of that city. The case quoted is

one the cavalry barracks, where the death rate of horses was 180 to 197 per 1,000 per annum. The stables were rebuilt on designs in which provisions was made for efficient drainage and ventilation, and during the following ten years the death rate fell to 28.50 per 1,000. Mr. Tidman says that seventy-five per cent of town stables in England, are in such an unsanitary state as to be dangerous to man and animals, and to this cause is attributed the prevalence of glanders and other diseases among horses.

PAINTING IRONWORK.—In many cases the object of painting iron is to prevent its rusting, fully as much as to improve the appearance; but in a great many cases the main object is not attained, as the iron will continue to rust under paint. Especially is this the case with coal tar when applied to cold iron and nearly always the case when oil paints are used, unless a compound made for this particular purpose is employed. The application of hot coal tar does not help the matter any, but if the iron be hot when the paint is applied or heated afterwards, the coal tar will make firmly adherent contact with the iron and prevent rusting. If oil paints are used it is necessary to make the first coat of composition that will closely adhere and, in fact, penetrate the pores of the iron. Ironwork exposed to the weather requires special treatment if the paint is to adhere firmly and act as a preventive of rust. A correspondent gives the plan he uses for such work. He says: "My first step is to clean thoroughly, and then if badly rusted to apply a thin mixture of lampblack with plenty of turps and driers and a little oil, and after this dries, apply red lead with half oil and half turps." This will give a lasting job, as the lampblack arrests and prevents the rusting. He might have added that the thinned coating penetrated deeper and made it adhere, while the gummy coating left from the evaporation of the "turps" made an efficient non-corrosive protective coating.

MUNICIPAL DEPARTMENT.

METHODS AND COST OF ROAD IMPROVEMENTS.

In St. Thomas all the improvements are made under the frontage tax system. Previous to the adoption of this system, and for some time after, a large amount of money was expended annually in hauling gravel for filling holes, patching and plastering streets and making gutters in an endeavor to relieve them of water, and to make the streets passable during the wet season. From this large expenditure, year after year, no beneficial results were noticeable. The citizens became disgusted and decided to deal with the question from a business standpoint, and the residents of a number of principal streets petitioned the council to devise a plan for the systematic and permanent improvement of the streets.

The first point decided upon was the width of road-way between the lines of the curbing. These range from twenty-two to twenty-eight feet according to the amount of traffic; this being decided, the question of the class of material to be used was taken up, the cost being the principal consideration. In the outset of a movement of this description it is difficult to convince the people that first-class material and work is the cheapest in the end. However, with us, as no doubt with other municipalities, the streets first petitioning were anxious that the road should be good, but that the cost should be kept as low as possible. Gravel, put on in sufficient quantities, was considered suitable. The levels were then taken and the grades established for an excavation the whole length of the street to such a depth that when the material was placed on the centre of the finished grade it would be beneath the surface of the adjoining lots, maintaining uniformity as far as possible. The excavation was curbed on each side with three inch cedar curbing. Gravel to the depth of nine inches in the centre and six inches at the curbing was placed thereon. After the excavation for the road-bed was made, tiles ranging from three inches to four inches in diameter were laid in the gutters and diagonally at intervals of from four to six rods from the centre of the road-way to the side drain beneath the sub-grade, with a fall, as near as could be, of three inches to the one hundred feet. These drains empty into the sewer catch-basins. This road-bed, labor, draining and material, exclusive of the curbing, costs twenty-four cents per square yard, or seventy-two

cents per running foot, the road-way being twenty-seven feet wide, or \$3,810.60 per mile. A width of eight feet would be sufficient for roadways in rural districts away from the immediate neighborhood of large towns. This would cost \$1,126.40 per mile, provided the gravel is as convenient to the work, viz., not more than three miles distant.

This improvement on completion was very satisfactory to the residents of the street and citizens in general, and not being subjected to heavy traffic made a good serviceable road-bed. The result that in the following year—1892—petitions were presented to the council for the improvement of six other streets; one about one and a half miles in length. On these streets heavier traffic had to be provided for, and I recommended that a more substantial foundation be made, and the following principle was adopted:

The road-bed was formed as above described, the whole of the sub-grade was covered with flake stone, of from three to five inches in thickness, and varying from eight inches square to two feet in the greatest face measurement, from the quarries at Hagersville on the Michigan Central Railway. This stone was laid by hand, carefully fitted together, the interstices being filled with chippings, forming a complete floor, it was then settled in its place by passing a five ton roller over the whole bed. Upon this bed was placed, four inches in depth, coarse creek gravel, which was thoroughly sprinkled and rolled by passing said roller over it about six times; upon this was placed sufficient gravel to complete the grade, making a depth of road material eleven inches in the centre and seven inches at the curb line. This was again sprinkled by the use of a watering cart, and repeatedly rolled, and material added where depressions were formed by the roller, until the whole was regularly crowned and brought to the finished grade line. The cost of this stone per cord, at the quarry, was \$1.25 on the cars; freighting eighty miles, \$2.05, unloading, 60 cents, making a total cost at the work, \$3.90 per cord.

The gravel was good creek gravel, hauled a distance of about three miles. The total cost of this road excavation and material complete was \$1.10 per lineal foot (28 feet between the curb lines), or \$5,808 per mile; this would be 31 cents per lineal foot for road-way eight feet wide, or \$1,638.80 per mile. Owing to the scarcity of first-class gravel we found that it was necessary at the close of the work in 1892 to look for some other material. We waited upon the owner of the Hagersville quarry and convinced him of the growing need of crushed stone, and guaranteed, if he put in a plant, to take from him during the season of 1893 one thousand cords of material, and as a result we have been using crushed stone for the past year. With this class of road the foundation is prepared in the manner described, but instead of using tiles for draining we make the excavations the same as for tiles, and fill them in with clean coarse crushed stone. After the road-bed is prepared the sub-grade is thoroughly rolled with a five ton roller until compacted, then stone crushed to pass through a two and one-half inch ring is placed thereon, to the depth of four inches, sprinkled and rolled, after which it is covered with stone crushed to pass through a one and one-half inch ring, three inches in the centre, and two inches at the sides, and again sprinkled and rolled, then a light coating of fine screenings, sufficient to thoroughly fill all the interstices is spread over the whole surface of the road-bed, which is sprinkled and rolled until thoroughly compacted, and when finished presents a smooth and even surface.

The stone cost us \$5.50 per cord f. o. b. cars, St. Thomas, making the road-bed excavation, material etc., exclusive of curbing cost \$1.08 per lineal foot (28 feet wide) or \$5,702.40 per mile, this for eight feet wide road-way would be \$1,754.58 per mile. These roads, when finished, have an elevation in the middle varying with the width of the road as follows:

Twenty-two feet four inches, twenty-four feet five inches, twenty-eight feet, seven inches twenty-six feet, seven inches.

I have found that a roadway constructed of good, clean gravel, with just sufficient earthy material among it to secure perfect consolidation to the proper depth, makes a good serviceable road, and with proper attention is cheap and suitable for localities where the gravel is easily obtained. But the objection to them is the amount of attention and material required for maintenance.

Gravel that is worn by water is to clean for this purpose, and that dug from the earth contains as a general thing, too much earth, which should be sifted out before using. In doing this we sift the gravel through two sieves; one is made of wire two inches apart, so that all stones above that size are rejected; the other has spaces of three-quarters of an inch, and the material which passed through it is not used. The expense of this sifting is not very great, and the work will be repaid by the superior condition of the material and the diminution of labor in keeping it in order.

Country roads as a rule do not require a wide roadway. If practical economy is studied the central part of the roadway need only be macadamized for a width of eight feet, this is sufficient width for vehicles to drive on. For roads approaching cities or large towns, it is necessary to provide for constant traffic in both directions, then the macadamized portion of the roadway should be 5 to 6 feet wide, as the axles of wagons and buggies are usually five feet eight inches in width, thus allowing a space of two feet from the

* Abstract of a paper read by A. W. Campbell, P. E., S. C. E. A., M. C. S., City Engineer of St. Thomas, Ont., before the Ontario Good Roads Association.